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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 14513.1-2017

**Pneumatic fluid power -- Determination of flow-rate
characteristics of components using compressible fluids -- Part
1: General rules and test methods for steady-state flow
(English Translation)**

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Foreword

GB/T 14513 "Determination of the flow characteristics of compressible fluid components using pneumatic" is divided into the following three parts.

--- Part 1. General rules and test methods for steady-state flow;

--- Part 2. Alternative test methods;

--- Part 3. Calculation of steady-state flow characteristics of the system.

This section GB/T 14513 Part 1.

This section drafted in accordance with GB/T 1.1-2009 given rules.

This Part replaces GB/T 14513-1993 "Determination of flow characteristics of pneumatic components," compared with GB/T 14513-1993 main technology the changes are as follows.

- Modify the "flow characteristics of pneumatic components" determination (see Chapter 1, 1993 edition Chapter 1);
- In the "normative references", modify and add some references (see Chapter 2, 1993 edition Chapter 2);
- In Terms and Definitions, the terms and definitions have been modified and added (see Chapter 3, Chapter 3 of the 1993 edition);
- Added "subsonic index m , cracking pressure Δp_{cr} " 2 characterization parameters to describe the plug flow and subsonic flow area gas flow Dynamic performance (see 3.4.5, 3.4.6, 6.3.2.1, 6.3.2.2, 6.3.2.3);
- Modify and add symbols and units (see 4.1, Table 2, Table 3, 1993 edition 4.1, 4.2, Table 1, Table 2);
- Modify the test device test circuit diagram (see Figure 1, 1993 version of Figure 1); added "upstream pressure change test test Loop "(see Figure 2);
- Added "test circuit components shown in Figure 1 and Figure 2" (see Table 4);
- Removed the "connection of the device under test" (see 1993 version 5.2);
- Deleted about the "gas content" (see 1993 version 5.3);
- Removed the "air filter" (see 1993 version 5.4);
- Removed the "test instrumentation" (see 1993 version 5.5);
- Added "General Requirements" (see 5.3);
- Added "pressure measuring tube" (see 5.4);
- Added "adapter" (see 5.5);
- Added "special requirements" (see 5.6);
- Modify the "test conditions" (see 6.1, 1993 version 6.1);
- Modify the "test procedure" (see 6.2, 1993 version 6.2);
- Modify the "characterization" (see 6.3, 1993 version 6.3);
- Modify the "test result expression" (see Chapter 7, 1993 edition Chapter 7);
- Added "label instructions" (see Chapter 8);
- Added "alternative test procedures" (see Appendix A);

- Added "flow meter calibration" (see Appendix B);
- Added "Measurement Uncertainty Assessment" (see Appendix C);
- Added "observation of the error in the test results" (see Appendix D);
- Added "expression of flow characteristics of the formula and graphics" (see Appendix E);
- Added "actual use of units" (see Appendix F);
- Added "expression of commercial pneumatic components test results" (see Appendix G);
- Added "Using the solver function in Microsoft Excel to calculate the critical back pressure ratio b and the subsonic speed factor Number m " (see Appendix H).

This section uses the translation method is equivalent to using ISO 6358-1:2013 "Determination of the flow characteristics of compressible fluid components using pneumatic drives Part 1. General rules and test methods for steady-state flow".

The documents of our country that are consistent with the corresponding international documents that are normative references in this section are as follows.

- GB/T 786.1-2009 Fluid power systems and components Graphical symbols and circuit diagrams Part 1. For general use and number According to the processing of graphic symbols (ISO 1219-1:2006, IDT);
- GB/T 7307-2001 Non-threaded sealing pipe thread Part 1. Dimensions, tolerances and labeling (equiv ISO 228-1.

1994)

- GB/T 17446-2012 fluid transmission systems and components vocabulary (ISO 5598:2008, IDT);
- GB/T 28783-2012 Pneumatic standard reference atmosphere (ISO 8778:2003, IDT);
- Pneumatic connection port and stud end (ISO 16030:2001/Amd.1.2005, IDT) --- GB/T 14038-2008;

For ease of use, this section made the following editorial changes.

- Standard name changed to "Pneumatic components using compressible fluid flow characteristics of the first part of the steady flow of general rules and test methods";
- Correct a small number of editorial errors in ISO 6358-1:2013, change "GUM.2000" in Appendix C.1 to "GUM." 2008".

This part is proposed by China Machinery Industry Federation.

This part of the National Hydraulic Pneumatic Standardization Technical Committee

(SAC/TC3) centralized.

This section is responsible for the drafting unit. National Pneumatic Product Quality Supervision and Inspection Center.

This section participates in the drafting unit. Ningbo Xingjian Aerospace Machinery Co., Ltd., Beijing University of Aeronautics and Astronautics, Wuxi Institute of Aerodynamic Technology Limited Company, Wenzhou Aerbe Pneumatic Co., Ltd., a constant pneumatic Co., Ltd., Zhejiang Braun Pneumatic Technology Co., Ltd., Zhejiang hydraulic pneumatic Seal Industry Association.

Introduction

In a pneumatic system, the pressure is passed through the circuit to transfer and control the energy. The components that make up the loop are inherent to the airflow. Therefore, it is necessary to define and determine its flow characteristics to describe their performance.

ISO 6358:1989 is based on a shrink nozzle model developed to determine the flow characteristics of pneumatic valves. This method includes two characteristic parameters, velocity-of-flow conductance C and critical pressure ratio b , are used for the recommended numerical approximation of flow characteristics. The method is based on static pressure. The test results describe the flow characteristics of pneumatic valves ranging from plug flow to subsonic flow. The new version of ISO 6358-1:2013 test taking into account the influence of the gas flow rate on the pressure measurement, stagnation pressure is used instead of the original static pressure.

Experience has shown that many pneumatic valves with shrinkage-expansion characteristics do not kiss well with models in the ISO 6358:1989 standard. Together, in addition, pneumatic components other than pneumatic valves also need to apply this standard. However, for the choke and subsonic flow zones, it is now required to use four parameters (C , b , m and Δp_c) to define the flow performance.

This section describes the four sets of flow characteristics obtained from the test results. These parameters are descending according to their priority order. Described below.

The sonic velocity guide C is the most important parameter which corresponds to the maximum flow rate (choke flow). This parameter is determined by the upstream stagnation condition.

The critical back pressure ratio, b , represents the demarcation point between the plug flow and the subsonic flow, which is the second most important parameter. It's defined as before the critical pressure ratio in ISO 6358:1989 is different because it characterizes the ratio of downstream stagnation pressure to upstream stagnation pressure.

Subsonic velocity index m , when necessary, can more accurately represent the subsonic flow behavior. For fixed flow channel components, m value about 0.5 or so. In this case, we